THE INTER-BRAIN: ITS RELATIONS TO THERMOTAXIS, POLYPNŒA, VASO-DILATION AND CONVULSIVE ACTION.

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THE floor of the inter-brain consists of a mass of gray matter which is prolonged in a funnel-shaped manner toward the base of the skull, constituting the tuber cinereum whose lumen, the infundibulum, is a continuation of the third or middle ventricle.

It has always been to me a matter of surprise that no experimentalist has been able to obtain a temperature of 109.5° F. in puncturing the thalamus. Girard[1] found that punctures into the thalami were followed by an elevation of temperature. In Mosso's[2] experiments an elevation of one to two degrees was seen, which quickly returned to normal. Dr. White, in his first paper[3] found an average rise of 2½° F. In his second paper[4] he states that in thalamic injuries the temperature never rose 2° F., the average rise being $\frac{9}{10}$° F., the highest being 1.7° F. Since the discovery that the tuber cinereum was a thermotaxic centre, I have made another series of experiments. It was found that the puncture at the anterior end of the thalami must enter the tuber cinereum to cause a rise of temperature. Several (fourteen) experiments were made upon etherized rabbits and cats, and in no case was there any marked rise unless the tuber was injured. When the skull was trephined and a very fine probe thrust through the cortex down to the base of the thalami, then the rise of temperature was 2.7° F.; or if in an etherized rabbit the carotids are clamped temporarily and the skull removed so as to lift the whole anterior part of the brain in an upward direction to expose the optic commissure, then a puncture into the tuber, causes a rise of 2.2° F. If I am fortunate to puncture on the median line of the tuber in the rabbit so as to injure the bilateral gray, then a temperature of $109^1/_2$° F. is obtained in a few hours.

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[1] Archiv. de Physiologie No. 4, 1888.

[2] Giornale della R. Accademia di Medicina di Torino, 1889.

[3] Foster's Journal of Physiology, vol. xi. Nos. 1 and 2, 1890.

[4] British Medical Journal, March, 1891.

In the paper upon vaso-tonic centres in the thalami I located them at their anterior part. Lately I have tried to more accurately determine the position of these centres. In the rabbit etherized I temporarily clamped the carotids, then removed the skull and lifted up the anterior half of the brain, so as to expose the tuber cinereum. Then the clamps were removed from the carotids, and one of them attached to the kymographion. After a registration of pulse and pressure ensued, I punctured the tuber with a fine probe, when a gradual fall of arterial tension ensued amounting in about forty minutes to about one-fourth the absolute pressure.

This fall invariably ensued in six experiments. These observations left no doubt in my mind that vaso-tonic centres existed in the thalami, or at least centres concerned in some manner in vaso-dilation. It is possible that this centre is a vaso-dilator, but it seems to me more probably vaso-tonic.

In some experiments[5] made upon the unpigmented feet of cats, it was found that centres located in the spinal cord were concerned in the vaso-dilation. If the sciatic was divided, then the corresponding foot did not become more vascular. When an animal is subjected to extreme heat, then heat impulses from the peripheral nerves excite the polypnœic centre, which sends excitations to the respiratory centre and causes rapid respiration, and a dissipation of heat through the moisture thrown off by the lungs.

In the same manner heat impulse arrives at the vaso-tonic centres, and causes them to relax their tonus over the capillaries, thus permitting them to dilate. Hence more blood is on the surface of the body and more heat dissipated from it. The arterial tension,[6] however, does not fall, although the vessels dilate because heat accelerates the heart, which pours more blood in a given time into the capillaries. Towards death the blood-pressure falls from heat. The thermotaxic centre in the tuber acts as a thermolytic centre through the respiratory and vaso-motor apparatuses. It may be difficult to understand how a centre concerned in the dissipation of heat could cause a rise of temperature upon puncture, but it must be remembered that increased dissipation is followed by increased production, and if the proportion is not the same, that is—heat dissipation and heat production—are not the same in equal periods of time, then the temperature will rise.

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[5] Journal of Physiology, vol. ii. No. 2.

[6] Vincent, Recherches experimentales sur l'Hyperthermie, 1887.

These facts cause a revision of the functions of the thermotaxic centres.

Fore Brain	Cortex-Thermo-inhibitory centres, (1) cruciate, (2) Sylvian. Base-Thermogenic centres, (1) caudate nucleus; (2) gray matter of septum lucidum (White); (3) gray matter in front of and beneath caudate nucleus.
Inter-Brain	(4) Thermolytic centres, Polypnœic and vaso-tonic centres in tuber cinereum.

After brain—Thermolytic centres—respiratory and vaso-motor.

Spinal Cord	Thermolytic centres.—Sudorific centres.—Thermogenic centres.

Puncture like fever poison excites the thermotaxic centres. Antipyretics act as sedatives to them, and reduce their excitability.

It was also noted that punctures into the tuber cinereum gave rise, occasionally, to convulsive movements. These spasms were of a clonic nature, and occurred about four times a minute.

Appended are a few of the twenty experiments.

EXPERIMENT I.—CAT.

Trephined and probe thrust through the opening.

A.M.	Temperature.
10.33	101.3
10.36.—Puncture into posterior edge of tuber cinereum between the crura.	
10.48	101.9
11.33	103.2
P.M.	
2.05	104.2

EXPERIMENT II.—RABBIT.

A.M.	Temperature.
9.20	$103^{3}/_{5}$
9.21.—Probe thrust through trephined opening in skull injuring the tuber cinereum and anterior edge of thalami.	
9.50	$103^{3}/_{5}$
10.50	$105^{2}/_{5}$
11.40	105.8
12.35	105.4

EXPERIMENT III.—RABBIT.

P.M.	Pulse.	Pressure.
3.35	50	90
3.35.15.—Brain elevated and tuber cinereum punctured.		
3.35.30	54	68
3.36	54	68
3.37	52	66
3.50	52	58
4.12	53	56
4.46	57	50

EXPERIMENT IV.—RABBIT.

P.M.	Pulse.	Pressure.
5.25	67	110
5.25.15.—Brain elevated and tuber cinereum punctured.		
5.26	67	114
5.27	67	108
5.35	68	98
5.40	65	68
5.46	71	72
6.25	77	84

EXPERIMENT V.—RABBIT.

P.M.	Pulse.	Pressure.
5.29	70	104
5.29.15.—Brain elevated and tuber cinereum punctured.		
5.30	72	86
5.41	72	76
5.42	75	72
5.45	70	80
5.56	76	84
6.10	73	70

EXPERIMENT IV.—RABBIT.

P.M.	Pulse.	Pressure.
4.09	68	108
4.10.—Brain elevated and tuber cinereum punctured.		
4.11	65	94
4 12	68	86
4.13	66	72
4.15	70	84
4.20	70	92
6.08	79	82